Most of the electricity that we use is generated in giant power stations. In this process a large amount of energy is lost into rivers or into the sea in the form of cooling water - or simply vanishes into thin air from cooling towers. On average, half of the energy input disappears this way. So from an energy-saving perspective co-generation of combined heat and power (CHP) is a very attractive solution.

Luc Brams, Stephen Thys

Energy Savings by Co-Generation of Heat and Power

In a combined heat and power co-generation plant electricity and heat are produced simultaneously on-site at the point of use. Losses due to heat and transmission are therefore reduced to practically zero. This is because heat production is the first priority of co-generation as compared with a traditional power station where electricity production is the main objective. Fuel consumption during the combined production of electricity and heat in a CHP plant is therefore much lower than the stand alone electricity generation of the same amount of energy and the total yield of a CHP plant is often around 85%.

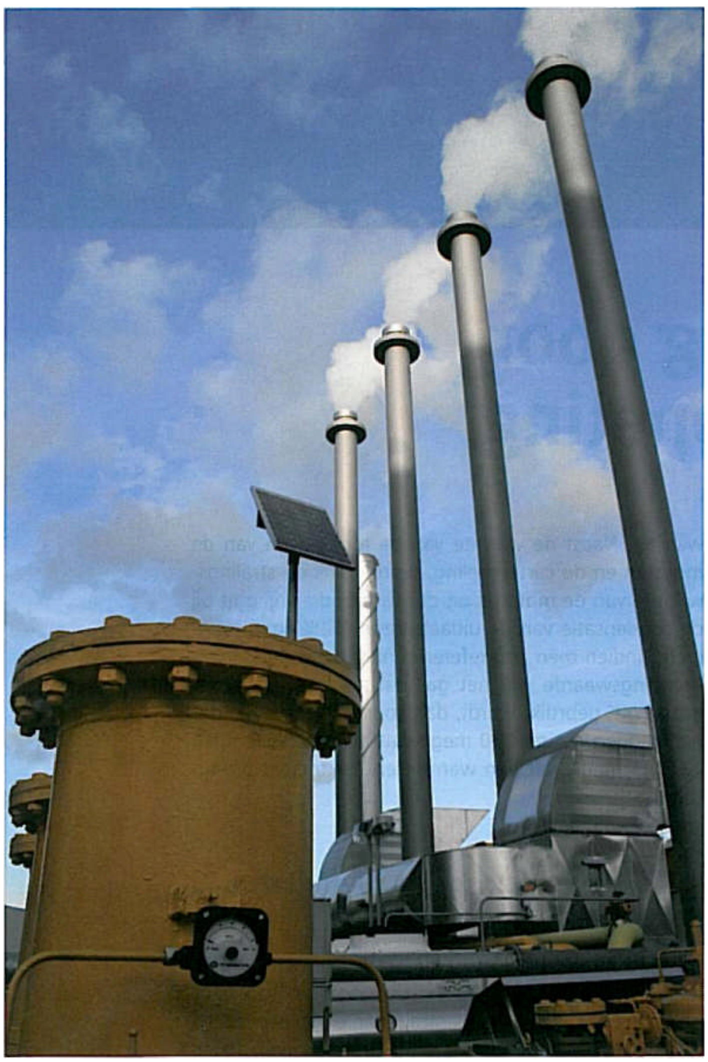
The Agfa CHP plant in Belgium, however, boasts a remarkable overall yield of more than 100 percent. This outstanding achievement is due to the clever combination of two factors: the use of engines with an excellent electrical yield (40%) and the recycling of all available heat. As well as recovering the waste heat in the engine exhaust gas the heat from jacket cooling, radiant heat and the heat released during condensation of the waste gasses are also recuperated (62%). In fact, based on the lower calorific value of the fuel gas used to power the plant it is possible to conclude that 20 megawatts of natural gas produces approximately 21 megawatts of heat and electricity.

High Electricity and Heat Yield

Four gas engines run together at the site to provide a total of eight megawatts of electricity. The engine exhaust gasses, at a temperature of 550°C, are used to produce 1.25 tonnes of steam with a pressure of 19 bar(abs) and temperature of 340 °C. The water is then raised to 90 °C, first by means of a waste gas economiser and then by the engine block cooler with a combined thermal capacity of 1.327 kW per engine. Agfa also make use of the low temperatures from, the intercooler of the CHP engine and the chimney condensation heat, with a thermal capacity of 555kW. Finally the radiant heat rejected by the engines (200kW) is recycled to provide warm air (35 °C) for the regeneration of air dryers in the casting rooms.

Agfa is also leading the way in Europe by the addition of an auxiliary firing system on the waste gases from the CHP natural gas engine. Afterburning is usually only found on gas turbines where the waste gases contain enough residual oxygen to ignite the injected natural gas. However since the oxygen content of the waste gases from an engine is less than that of a turbine, after-burning can only be achieved by the addition of fresh air. By injecting more oxygen the burner can heat the gases from 550 °C to 1500 °C. Since it is not necessary to use the existing boiler to produce this surplus the result is a further primary energy saving of 367 kW. However the system has other advantages. The benefit of the after burner which uses 3,269 kW of natural gas is that 5.2 tonnes of steam per hour can be produced from the Clayton Exhaust Gas Boiler instead of 1.2 tonnes - a yield of nearly 100%.

Chimney on each engine



Up to 33% Primary Energy Saving

A high yield power station uses 3940 kW of natural gas to produce 1970 kW of electricity which represents a yield of 50%. A boiler with a yield of 85% uses 1135 kW of natural gas to produce 965 kW of steam. For the production of 1882 kW of hot water at 90 °C and 40 °C the gas consumption in a high yield boiler will result in a total consumption of natural gas of 2091 kW. For 200 kW of hot air an additional 215 kW of natural gas is required. All in all these together consume a total of 7381 kW of natural gas.

By comparison the Agfa CHP plant consumes slightly less than 4930 kW for the production of the same amounts of electricity, steam and hot air. The natural gas consumption of the CHP power station is a stunning 33% lower than the consumption of individual plants. This is the primary energy saving which is not only reflected in the fuel bill, but also determines the number of CHP certificates that can be claimed.

Rapid Payback

Since the four CHP engines operate for around 8000 hours per annum, the primary energy saving of 78,500 MWh is quite considerable. The Flemish District recognizes this energy saving by awarding 1 CHP certificate per megawatt hour. The government requires energy suppliers to produce a certain proportion of their electricity from CHP and there is a fine of 45 euros per MWh for non compliance. As an alternative to the penalty the producers can buy certificates from owners of CHP plants and in this way these companies receive an indirect subsidy for energy-saving initiatives. The average price of a certificate is determined by the market, but it is probably not far from the cost of the fine. The 78,500 CHP certificates which Agfa receive from the Flemish Energy Regulator (VREG) can be sold to a producer of electricity in accordance with a standard procedure. In addition the price of natural gas is much cheaper than the price of electricity since the cost of electricity per megawatt hour is around three times that of natural gas. The quantity of natural gas required to produce one megawatt hour of electricity in the CHP plant costs 25 euro which produces an annual saving of more than 3.2 million euros. Thanks to the combination of the price of energy (which has risen steeply so the price difference between gas and electricity even greater) and the support mechanism of the CHP certificates a project like this makes it possible to recover the costs within two years.

Intelligent Design and Seamless Integration

Heat recovery is one thing but optimum use of the recovered heat is a challenge. The internal engineering office of Agfa has been involved in modifying and integrating this technology in Agfa's own processes in such a way that this objective could be achieved. Agfa Materials Engineering now offers its expertise to the industrial marketplace and some of their specialties include conceptual studies, design and implementation of process and energy technologies as well as mechanical equipment design services.

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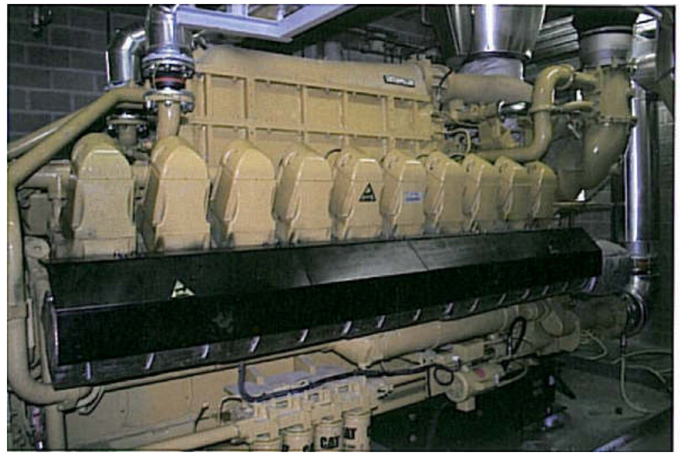
The Agfa-Gevaert Group is a world leader in the field of imaging and information technology. Agfa develops, produces and distributes analogue and digital systems for the printing industry (Agfa Graphics), the care sector (Agfa Healthcare) and specific industrial applications (Agfa maerials). The group has a presence in 40 countries.



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